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RNS INSTITUTE OF TECHNOLOGY

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(NAAC 'A+ Grade' Accredited, NBA Accredited (UG - CSE, ECE, ISE, EIE and EEE)
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ESTD : 2001
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DEPARTMENT OF MATHEMATICS

Question Bank

SUBJECT CODE AND TITLE	**Engineering Mathematics – II (CS & allied branches) BMATS201**		
SCHEME	**2024**	**BATCH**	**2024**
SEMESTER& SECTION	**II Semester (CS & allied branches)**		
FACULTY NAME			

Q.No.	Question	Marks	RBT*	COs
	Module 1			
1.	Find the unit normal to the surface $yz + zx + xy = c$ at the point $(1,2,-1)$.	6/7	L3	CO1
2.	Find the unit normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point $(1,2,-1)$.	6/7	L3	CO1
3.	Find the unit vector normal to the surface $xy^3z^2 = 4$ at $(-1,-1,2)$.	6/7	L3	CO1
4.	Find the directional derivative of $\emptyset = x^2yz + 4xz^2$ at (1, -2, -1) along $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$.	6/7	L3	CO1
5.	Find the directional derivative of $4xz^3 - 3x^2y^2z$ at (2, -1, 2) along $2\hat{i} - 3\hat{j} + 6\hat{k}$.	6/7	L3	CO1
6.	Find the direction derivative of $\phi = xy^2 + yz^3$ at $(2,-1,1)$ in the direction of the normal to the surface $x\log z - y^2 = -4$ at $(-1,2,1)$.	6/7	L3	CO1
7.	Find the directional derivative of $\phi = x^2 + y^2 + 2z^2$ at P (1, 2, 3) in the direction of the vector $\overrightarrow{PQ} = 4\hat{\imath} - 2\hat{\jmath} + \hat{k}$.	6/7	L3	CO1
8.	Find a, b, c so that the directional derivative of $\phi = axy^2 + byz + cz^2x^3$ at $(1,2,-1)$ has the maximum magnitude 64 in the direction parallel to the z-axis.	6/7	L3	CO1
9.	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ & $z = x^2 + y^2 - 3$ at $(2,-1,2)$.	6/7	L3	CO1
10.	Show that the surfaces $4x^2y + z^4 = 12$ and $6x^2 - yz = 9x$ intersect orthogonally at the point (1, -1, 2).	6/7	L3	CO1
11.	Find the angle between the directions of the normal to the surface $x^2yz = 1 = z^2$ at the points $(-1,1,1)$ and $(1,-1,-1)$.	6/7	L3	CO1

12.	Find $\nabla\phi$ if $\phi = \log\,(x^2+y^2+z^2)$	6/7	L3	CO1
13.	Find $\nabla\phi$ if $\phi = x^3+y^3+z^3-3xyz$ at the point $(1,-1,2)$.	6/7	L3	CO1
14.	Find $\nabla\phi$ if $\phi = 3x^2y-y^3z^2$ at the point (1,-2, -1).	6/7	L3	CO1
15.	If $\vec{F} = \nabla(x^3+y^3+z^3-3xyz)$ find $div\,\vec{F}$ and $curl\,\vec{F}$.	6/7	L3	CO1
16.	Find $div\vec{F}$ and $curl\vec{F}$ if $\vec{F} = xyz^2\hat{\imath}+xy^2z\hat{\jmath}+x^2yz\hat{k}$.	6/7	L3	CO1
17.	If $\vec{F} = \nabla(xy^3z^2)$ find $div\,\vec{F}$ and $curl\,\vec{F}$ at the point $(1,-1,\ 1)$.	6/7	L3	CO1
18.	Show that the vector $\vec{F} = (-x^2+yz)\hat{\imath}+(4y-z^2x)\hat{\jmath}+(2xz-4z)\hat{k}$ is solenoidal.	6/7	L3	CO1
19.	Show that the vector $\vec{V} = 3y^4z^2\hat{\imath}+4x^3z^2\hat{\jmath}+3x^2y^2\hat{k}$ is solenoidal.	6/7	L3	CO1
20.	Find the constant a so that the vector field $\vec{F} = (x+3y)\hat{\imath}+(y-2z)\hat{\jmath}+(x-az)\hat{k}$ is solenoidal.	6/7	L3	CO1
21.	Show that the vector $\vec{F} = \frac{x\hat{\imath}+y\hat{\jmath}}{x^2+y^2}$ is both solenoidal and irrotational.	6/7	L3	CO1
22.	Find the values of a,b,c such that $\vec{F} = (axy+bz^3)\hat{\imath}+(3x^2-cz)\hat{\jmath}+(3xz^2-y)\hat{k}$ is irrotational, also find the scalar potential ϕ such that $\vec{F} = \nabla\phi$.	6/7	L3	CO1
23.	Show that $\vec{f} = 2xyz^3\,\hat{\imath}+x^2z^3\hat{\jmath}+3x^2y\,z^2\hat{k}$ is irrotational and find ϕ such that $\vec{f} = \nabla\phi$.	6/7	L3	CO1
24.	Show that $\vec{F} = (z+sin\,y)\hat{\imath}+(x\,cos\,y-z)x^2\hat{\jmath}+(x-y)\,\hat{k}$ is irrotational and hence find a scalar potential ϕ such that $\vec{F} = \nabla\phi$.	6/7	L3	CO1
25.	Show that $\vec{F} = (y+z)\hat{\imath}+(z+x)\hat{\jmath}+(x+y)\,\hat{k}$ is irrotational and hence find a scalar potential ϕ such that $\vec{F} = \nabla\phi$.	6/7	L3	CO1
26.	Prove that the cylindrical system is orthogonal.	6/7	L2	CO1
27.	Prove that the Spherical system is orthogonal.	6/7	L2	CO1
28.	Express the vector $\vec{A} = z\hat{\imath}-2x\hat{\jmath}+y\hat{k}$ in cylindrical coordinates.	6/7	L3	CO1
29.	Express the vector $\vec{A} = 2x\hat{\imath}-3y^2\hat{\jmath}+xz\hat{k}$ in cylindrical coordinates.	6/7	L3	CO1
30.	Represent $\vec{F} = y\hat{\imath}-z\hat{\jmath}+x\hat{k}$ in spherical polar coordinates and hence find F_r, F_θ, F_ϕ .	6/7	L3	CO1
	Module 2			
1.	Prove that the subset W = {(x, y, z) : ax + by + cz = 0;x, y, z ϵ R} of the vector space R^3 is a subspace of R^3 .	6/7	L2	CO2
2.	Prove that the subset W = {(x, y, z) | x – 3y + 4z = 0} of the vector space R^3 is a subspace of R^3 .	6/7	L2	CO2
3.	Let $V = R^3$ be a vector space and consider the subset W of V consisting of vectors of the form (a, a^2, b), where the second component is the square of the first. Is W a subspace of V?	6/7	L3	CO2
	Show that W is a subspace of $V(R)$ where $W = \{f\!: f(a) = 0\}$	6/7	L2	CO2

4.				
5.	Express the matrix $A = \begin{bmatrix} 3 & -1 \\ 1 & -2 \end{bmatrix}$ in the vector space of 2×2 matrices as a linear combination of $B = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}, C = \begin{bmatrix} 1 & 1 \\ -1 & 0 \end{bmatrix}, D = \begin{bmatrix} 1 & -1 \\ 0 & 0 \end{bmatrix}$	6/7	L3	CO2
6.	Determine whether the matrix $\begin{bmatrix} -1 & 7 \\ 8 & -1 \end{bmatrix}$ is a linear combination of $\begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$, $\begin{bmatrix} 2 & -3 \\ 0 & 2 \end{bmatrix}$ and $\begin{bmatrix} 0 & 1 \\ 2 & 0 \end{bmatrix}$ in the vector space M_{22} of 2×2 matrices.	6/7	L3	CO2
7.	Express the matrix $\begin{bmatrix} 2 & 0 \\ 4 & -5 \end{bmatrix}$ as a linear combination of the matrices $A = \begin{bmatrix} 0 & -3 \\ 2 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 0 \\ 2 & 1 \end{bmatrix}, C = \begin{bmatrix} 2 & 3 \\ 0 & 5 \end{bmatrix}$	6/7	L3	CO2
8.	Express the vector $v = (1, -2, 5)$ as a linear combination of the vectors $v_1 = (1, 1, 1)$, $v_2 = (1, 2, 3)$, $v_3 = (2, -1, 1)$ in the vector space $R^3(R)$.	6/7	L3	CO2
9.	Write the vector $v = (4, 2, 1)$ as a linear combination of the vectors $u_1 = (1, -3, 2), u_2 = (0, 1, 2), u_3 = (5, 1, 37)$.	6/7	L3	CO2
10.	Let $f(x) = 2x^2 - 5$ and $g(x) = x + 1$. Show that the function $h(x) = 4x^2 + 3x - 7$ lies in the subspace $Span\ \{f, g\}$ of P_2 .	6/7	L2	CO2
11.	Check whether the vectors $v_1 = (1, 2, 3), v_2 = (3, 1, 7), v_3 = (2, 5, 8)$ are linearly dependent or linearly independent.	6/7	L3	CO2
12.	Check whether the vectors $v_1 = (2, 2, 1), v_2 = (1, 3, 7), v_3 = (1, 2, 2)$ are linearly dependent or linearly independent.	6/7	L3	CO2
13.	Check whether the vectors $v_1 = (1, 9, 3), v_2 = (2, 5, 4), v_3 = (0, 0, 0)$ are linearly dependent or not.	6/7	L3	CO2
14.	Show that the vectors $(1, 1\ 2, 4), (2, -1, -5, 2), (1, -1, -4, 0)$ and (2, 1, 1, 6) are linearly dependent.	6/7	L2	CO2
15.	Let V be a vector space of all 2×3 matrices over R. Show that the matrices $A = \begin{bmatrix} 2 & 1 & -1 \\ 3 & -2 & 4 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 & -3 \\ 2 & 0 & 5 \end{bmatrix}, C = \begin{bmatrix} 4 & -1 & 2 \\ 1 & -2 & 3 \end{bmatrix}$ form a linearly independent set.	6/7	L3	CO2
16.	Find the basis and the dimension of the subspace spanned by the vectors $\{(2, 4, 2), (1, -1, 0, (1, 2, 1), (0, 3, 1)\}$ in $V_3(R)$.	6/7	L3	CO2
17.	Prove that $T: R^3 \to R^3$ defined by $T(x, y) = (2x - 3y, x + 4\ ,5z)$ is not a linear transformation.	6/7	L2	CO2
18.	Show that the function $T: R^3 \to R^3$ given by $T(x, y) = (x + y, x - y, y)$ is a linear transformation.	6/7	L2	CO2
19.	Prove that the transformation $T: R^2 \to R^2$ defined by $T(x, y) = (3x, x + y)$ is linear. Find the images of the vectors $(1, 3)$ and $(-1, 2)$ under this transformation.	6/7	L2	CO2
20.	Let P_n be the vector space of real polynomial functions of degree ≤ n. Show that the transformation $T: P_2 \to P_1$ defined by $T(ax^2 + bx + c) = (a + b)\ x + c$ is linear.	6/7	L2	CO2
21.	Find the kernel and range of the linear operator $T\ (x, y, z) = (x + y, z)$ of $R^3 \to R^2$.	6/7	L3	CO2
22.	Find the matrix of the linear transformation $T: V_2(R) \to V_3(R)$ such that $T(-1, 1) = (-1, 0, 2)$ and $T\ (2, 1) = (1, 2, 1)$.	6/7	L3	CO2
23.	Verify the rank nullity theorem for the linear transformation $T: R^3 \to R^3$ defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$.	6/7	L3	CO2

24.	Verify the Rank-nullity theorem for the linear transformation $T: V_3(R) \rightarrow V_2(R)$ defined by $T(x, y, z) = (y - x, y - z)$.	6/7	L3	CO2
25.	Show that the functions $f(x) = 3x - 2$ and $g(x) = x$ are orthogonal in Pn with inner product $\langle f, g \rangle = \int_0^1 f(x)g(x)\, dx$.	6/7	L2	CO2
26.	Define an Inner Product Space. Consider $f(t) = 4t + 3, g(t) = t^2$, the inner product $\langle f, t \rangle = \int_0^1 f(t)g(t)\, dt$. Find $\langle f, g \rangle$ and $\|g\|$.	6/7	L3	CO2
27.	Consider the vectors $u = (1,2,4), v = (2, -3, 5)\ and\ w = (4,2,-3)$ in R^3, find (i) $\langle u.v \rangle$ $(ii)\langle u.w \rangle$ $(iii)\langle v.w \rangle$ $(iv)\langle (u + v).w \rangle$	6/7	L3	CO2
28.	Consider the vectors $u = (1,5)$ and $v = (3,4)$ in R^2, find (i) $\langle u, v \rangle$ with respect to the usual inner product in R^2. (ii) $\|v\|$ using the inner product in R^2.	6/7	L3	CO2
29.	Consider $f(t) = t + 2, g(t) = 3t - 2, h(t) = t^2 - 2t - 3$ and inner product $\langle f, g \rangle = \int_0^1 f(t)g(t)\, dt$. (i) Find $\langle f, g \rangle$ and $\langle f, h \rangle$ (ii) Find $\|f\|$ and $\|g\|$ (iii) Normalize f & g.	6/7	L3	CO2
30.	Verify the vectors $u = (1,1,1), v = (1,2,-3), w = (1,-4,3)$ in R^3 are orthogonal or not.	6/7	L3	CO2
	Module 3			
1	Find an approximate value of the root of the equation xe^x= 3, with(1,2) using the Regula-Falsi method, carry out three iterations	6/7	L3	CO3
2	Compute the real root of the equation $x\log_{10} x = 1.2$ and root lies between (2,3) by the method of false position , carryout 3 iterations.	6/7	L3	CO3
3	Find the root of the equation $xe^x - cosx = 0$ with (0,1) by the method of false position.	6/7	L3	CO3
4	Find the real root of the equation cos x =xe^x, which is nearer to x = 0.5 by the Newton-Raphson method, correct to three decimal places.	6/7	L3	CO3
5	Find the fourth root of 32 by Regula Falsi method correct to 3 decimal places.	6/7	L3	CO3
6	Find the real root of the equation 3x = cos x + 1 , which is nearer to x=1 correct to three decimal places using Newton's Raphson method.	6/7	L3	CO3
7	Find the real root of the equation xtanx+1=0 , which is nearer to x=π correct to three decimal places using Newton's Raphson method.	6/7	L3	CO3
8	Find an approximate root of the equation $x^3 - 3x + 4 = 0$ using the method of false position, correct to three decimal places which lie between -3 and -2. (Carry out three iterations).	6/7	L3	CO3
9	Given, sin 45°= 0.7071, sin 50° = 0.7660, sin 55° = 0.8192, sin 60°= 0.8660, find sin 48° using Newton's forward interpolation formula.	6/7	L3	CO3
10	From the data given below find the number of students who obtained (i) less than 40 marks, (ii) between 40 and 45 marks x: 0-40, 41-50, 51-60, 61-70, 71-80 y: 31, 42, 51, 35, 31	6/7	L3	CO3
11	The area A of a circle of diameter d given for the following values d: 80, 85, 90, 95, 100 A: 5026, 5674, 6362, 7088, 7854	6/7	L3	CO3

<table>
<tr><td></td><td>Calculate the area of a circle of diameter 105.</td><td></td><td></td><td></td></tr>
<tr><td>12</td><td>Using Newton's appropriate interpolation formula, find the values of y at x = 8 and at x = 22 from the following table:
<table>
<tr><td>x</td><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td></tr>
<tr><td>y</td><td>7</td><td>11</td><td>14</td><td>18</td><td>24</td><td>32</td></tr>
</table></td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>13</td><td>Find y(8) from y(1)=24,y(3)=120,y(5)=336,y(7)=720 by using Newton's backward interpolation formula.</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>14</td><td>Using Newton's appropriate interpolation formula, find the values of y (0.12) from the following table:
<table>
<tr><td>x</td><td>0.10</td><td>0.15</td><td>0.20</td><td>0.25</td><td>0.30</td></tr>
<tr><td>y</td><td>0.1003</td><td>0.1511</td><td>0.2027</td><td>0.2553</td><td>0.3033</td></tr>
</table></td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>15</td><td>Using Newton's divided difference formula, evaluate $f(8)$ from the following :
<table>
<tr><td>x</td><td>4</td><td>5</td><td>7</td><td>10</td><td>11</td><td>13</td></tr>
<tr><td>F(x)</td><td>48</td><td>100</td><td>294</td><td>900</td><td>1210</td><td>2028</td></tr>
</table></td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>16</td><td>Construct the interpolation polynomial for the data using Newton's divided difference formula:
<table>
<tr><td>x</td><td>2</td><td>4</td><td>5</td><td>6</td><td>8</td><td>10</td></tr>
<tr><td>y</td><td>10</td><td>96</td><td>196</td><td>350</td><td>868</td><td>1746</td></tr>
</table></td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>17</td><td>Find y at x = 5 if $y(1) = -3$, $y(3) = 9$, $y(4) = 30$, $y(6) = 132$ using Lagrange's interpolation formula</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>18</td><td>Use Lagrange's interpolation formula to fit a polynomial for the data: Hence estimate y at x=2.
<table>
<tr><td>x</td><td>0</td><td>1</td><td>3</td><td>4</td></tr>
<tr><td>y</td><td>-12</td><td>0</td><td>6</td><td>12</td></tr>
</table></td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>19</td><td>Use Lagrange's interpolation formula to fit a polynomial for the data: Hence estimate y at x=10
<table>
<tr><td>x</td><td>5</td><td>6</td><td>9</td><td>11</td></tr>
<tr><td>y</td><td>12</td><td>13</td><td>13</td><td>16</td></tr>
</table></td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>20</td><td>Evaluate $\int_0^1 \frac{1}{1+x^2} dx$using the Trapezoidal rule by taking 6 divisions.</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>21</td><td>Evaluate $\int_0^3 \frac{1}{4x+5} dx$by using Simpson's 1/3rd rule by taking 7 ordinates</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>22</td><td>Evaluate $\int_0^1 \frac{1}{1+x} dx$ by taking 7 ordinates and by using Simpson's 3/8 rule.</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>23</td><td>Evaluate $\int_0^1 \frac{1}{1+x^2} dx$using the Simpson's 1/3rd rule by taking 6 divisions.hence find an approximate value of π.</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>24</td><td>Evaluate $\int_0^{\pi/2} cosx dx$ by using Simpson's 1/3rd rule by taking 11 ordinates.</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
<tr><td>25</td><td>Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ by taking 7 ordinates and by using (i) Simpson's 1/3rd</td><td>6/7</td><td>L3</td><td>CO3</td></tr>
</table>

	rule (ii) Simpson's 3/8 rule.compare with its actual value.			
26	Evaluate $I = \int_0^1 \frac{x}{1+x^2} dx$ with n=6 by using Simpson's 3/8 rule.hence find an approximate value of log2.	6/7	L3	CO3
	Module 4			
1.	Using the Taylor series method find the approximate value of y(0.1) from $\frac{dy}{dx} = 3x + y^2$, with $y(0) = 1$	6/7	L3	CO4
2.	Apply the Runge Kutta method to find y(0.2), if $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$ with $y(0) = 1$	6/7	L3	CO4
3.	Using Milne's predictor corrector method find y(4.5) given $\frac{dy}{dx} = \frac{2-y^2}{5x}$ and $y(4.1) = 1.0049, y(4.2) = 1.0097, y(4.3) = 1.0143, y(4.4) = 1.0187$.	6/7	L3	CO4
4.	Using Modified Euler's method find y(0.1) taking h=0.05 given that $\frac{dy}{dx} = x^2 + y$, with $y(0) = 1$	6/7	L3	CO4
5.	Using the Runge Kutta method of order 4, find y(0.2) given that $\frac{dy}{dx} = 3x + \frac{y}{2}$, given that $y(0) = 1$.(take h=0.2)	6/7	L3	CO4
6.	Find y(1.4) using Milne's predictor-corrector method given that $\frac{dy}{dx} = x^2(1 + y)$; with $y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548$ and $y(1.3) = 1.979$ apply corrector formula twice.	6/7	L3	CO4
7.	Use the Taylor series method to find y(0.1) from $\frac{dy}{dx} = x^2y - 1$, with $y(0) = 1$. Consider upto 4th degree term.	6/7	L3	CO4
8.	Using modified Euler's method, solve the initial value problem $\frac{dy}{dx} = log_{10}\left(\frac{x}{y}\right)$; with $y(20) = 5$ at x=20.2 by taking h=0.2 apply modification three times.	6/7	L3	CO4
9.	Applying Milne's Predictor corrector method find y(2.0) from $\frac{dy}{dx} = \frac{x+y}{2}, given\ that\ y(0) = 2, y(0.5) = 2.6360, y(1.0) = 3.5950, y(1.5) = 4.9680$	6/7	L3	CO4
10.	Solve $\frac{dy}{dx} = e^x - y$, with $y(0) = 2$ using Taylor's series method upto 4th degree terms and find y(1.1)	6/7	L3	CO4
11.	Find y(1.1) by using Runge kutta method of fourth order. Given $\frac{dy}{dx} = x(y)^{1/3}, y(1) = 1$[take h=0.1]	6/7	L3	CO4
12.	Applying Milne's predictor corrector method to find y(1.4) from $\frac{dy}{dx} = x^2 + \frac{y}{2}$, given that $y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4549, y(1.3) = 2.7514$	6/7	L3	CO4
13.	Employ taylor's series method to obtain approximate value of y at x = 0.1 for the differential equation $\frac{dy}{dx} = 2y + 3e^x, y(0) = 0$.	6/7	L3	CO4
14.	Given $\frac{dy}{dx} = x + siny, y(0) = 1$.Compute y(0.4) with h = 0.2 using Euler's modified method.	6/7	L3	CO4
15.	Solve the differential equation $\frac{dy}{dx} = x + \lvert\sqrt{y}\rvert$ under the initial condition $y(0) = 1$, by using modified Euler's method at the point x = 0.4.Perform two iterations at each step, taking h=0.2	6/7	L3	CO4
16.	Using Modified Euler's method find y(0.2) given that $y' =$	6/7	L3	CO4

<table>
<tr><td></td><td>$\frac{x-y}{2}, y(0) = 1$[h=0.1]</td><td></td><td></td><td></td></tr>
<tr><td>17.</td><td>Using Runge Kutta method of fourth order find $y(0.2)$ from $\frac{dy}{dx} = x + y, y(0) = 1$ taking h=0.2</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>18.</td><td>Given that $\frac{dy}{dx} = x - y^2$, find y at x=0.8 with
<table><tr><td>x</td><td>0</td><td>0.2</td><td>0.4</td><td>0.6</td></tr><tr><td>y</td><td>0</td><td>0.02</td><td>0.0795</td><td>0.1762</td></tr></table>By applying Milne’s method. Apply correct formula.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>19.</td><td>If $\frac{dy}{dx} = 2e^x - y, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.04, y(0.3) = 2.09$ find $y(0.4)$ using Milne’s method.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>20.</td><td>Solve by Taylor’s series method the equation $\frac{dy}{dx} = log(xy)$ for y(1.1) and y(1.2) given y(1)=2.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>21.</td><td>Using Taylor’s series method find the solution of $\frac{dy}{dx} = x^2 + y^2$, with $y(0) = 1$ at $x = 0.1$ and $x = 0.2$ of order four.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>22.</td><td>Solve $\frac{dy}{dx} = x^3 + y, y(1) = 1$ using Talyor’s series method considering up to fourth degree terms and find $y(1.1)$</td><td></td><td></td><td>CO4</td></tr>
<tr><td>23.</td><td>Use fourth order Runge Kutta method, to find $y(0.8)$ with $h = 0.4$, given $\frac{dy}{dx} = \sqrt{x+y}, y(0.4) = 0.41$</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>24.</td><td>Solve initial value problem $\frac{dy}{dx} = x + y^2$, with $y(0) = 1$ at $x = 0.1$ by taking h=0.1 using the Runge-Kutta method of order 4.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>25.</td><td>Use Runge-Kutta method of fourth order to solve $\frac{dy}{dx} + y = 2x \; at \; x = 1.1$ given $y(1) = 3$, take h=0.1</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>26.</td><td>Apply Runge Kutta fourth order method to find $y(0.1)$ with h=0.1 given $\frac{dy}{dx} + y + xy^2 = 0, \; y(0) = 1$.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>27.</td><td>Use fourth order Runge kutta method to solve $(x + y)\frac{dy}{dx} = 1, \; y(0.4) = 1$ at x=0.5 correct to four decimal places.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>28.</td><td>Using Runge kutta method of fourth order, solve $y' = log_{10}\left[\frac{y}{1-x}\right]$ given $y(0) = 1$ at $x = 0.2$</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>29.</td><td>Apply Milne’s predictor corrector formulae to compute y(0.4) given $\frac{dy}{dx} = 2e^x y$, with
<table><tr><td>x</td><td>0</td><td>0.1</td><td>0.2</td><td>0.3</td></tr><tr><td>y</td><td>2.4</td><td>2.473</td><td>3.129</td><td>4.059</td></tr></table></td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>30.</td><td>Apply Milne’s predictor and corrector method find y at x=2 given $\frac{dy}{dx} = \frac{2y}{x} \; (x \neq 0)$</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>31.</td><td>Using modified Euler’s method, find y at x=0.2 from $\frac{dy}{dx} = 3x + \frac{y}{2}$ With y(0)=1 taking h=0.1 perform two iteration at each step.</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td>32.</td><td>Using modified Euler’s method compute y(1.1) correct to four decimal places given that $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2} \; and \; y = 1 \; at \; x = 1$.[h=0.1]</td><td>6/7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>Module 5</td><td></td><td></td><td></td></tr>
</table>

1	A random variable X has the following probability function: x: 0, 1, 2, 3, 4, 5, 6, 7 p(x): 0, k, 2k, 2k, 3k, k^2, $2k^2$, $7k^2+k$ (i) Find the value of k. (ii) (ii) Evaluate $P(X<6),\ P(0<X<5)\ and\ P(3<X\leq 6)$	6/7	L3	CO5
2	The probability density function P(x) of a variate x is given by the following table: x: 0, 1, 2, 3, 4, 5, 6 p(x): k, 3k, 5k, 7k, 9k, 11k, 13k (i) For what value of k, does this represent a valid probability distribution (ii) Find $P(x<4), P(x\geq 5)\ and\ P(3<x\leq 6)$ (iii) Determine the minimum value of k so that P(k<=2) >= 0	6/7	L3	CO5
3	A fair coin is tossed 3 times. Let X denote the number of heads showing up. Find the distribution of X. Also find its mean, variance and SD.	6/7	L3	CO5
4	Find mean and standard deviation of Binomial distribution.	6/7	L1	CO5
5	The probability of a pen manufactured by a factory will be defective is 1/10. If 12 such pens are manufactured, What is the probability that (i) exactly 2 are defective (ii) at least 2 are defective (iii) none of them are defective.	6/7	L3	CO5
6	The number of telephone lines busy at an instant of time is a binomial variate with probability of 0.2. If at an instant 10 lines are chosen at random, what is the probability that (i) no line is busy? (ii) 5 lines are busy? (iii) at least one line busy? (iv) at most 2 lines are busy? (v) all lines are busy?	6/7	L3	CO5
7	A die is tossed thrice. A success is '$getting\ 1\ or\ 6$' on a toss. Find the mean and variance of the number of successes.	6/7	L3	CO5
8	Out of 800 families with 5 children each, how many would you expect to have (i) 3 boys (ii) At least one boy At most two boys, assuming equal probabilities for boys and girls	6/7	L3	CO5
9	Find the mean and Standard deviation of Poisson distribution.	6/7	L1	CO5
10	If the probability of a bad reaction from a certain injection is 0.001. Determine the chance that out of 2000 individuals more than 2 will get a bad reaction.	6/7	L3	CO5
11	2% of the fuses manufactured by a firm are found to be defective. Find the probability that the box containing 200 fuses contains (i) no defective fuse (ii) 3 or more defective fuses.	6/7	L3	CO5
12	In a factory producing blades, the probability of any blade being defective is 0.002. If blades are supplied in packets of 10. Using Poisson distribution determine the number of packets containing, (i) No defective (ii) One defective	6/7	L3	CO5

	Two defective blades respectively in a consignment of 10,000 packets			
13	The probability that a news reader commits no mistake in reading the news is $1/e^3$. Find the probability that on a particular news broadcast he commits (i) Only 2 mistakes (ii) More than 3 mistakes (iii) At most 3 mistakes.	6/7	L3	CO5
14	A random variable x has the following density function $P(X) = \begin{cases} Kx^2 & -3 \le x \le 3 \\ 0 & elsewhere \end{cases}$ (i) Find the value of K (ii) Evaluate $P(x \le 1), P(1 \le x \le 2),\ P(x > 2)\ and\ P(x \le 2)$	6/7	L3	CO5
15	The probability density function of a continuous random variable x is $p(x) = \begin{cases} kx, & for\ 0 \le x < 2 \\ 2k, & for\ 2 \le x < 4 \\ 6k - kx, & for\ 4 \le x \le 6 \\ 0, & elsewhere \end{cases}$ Find k and then determine the mean of x.	6/7	L3	CO5
16	The frequency distribution of a measurable characteristic varying between 0 and 2 is as $f(x) = \begin{cases} x^3, & 0 \le x \le 1 \\ (2-x)^2, & 1 \le x \le 2 \end{cases}$ Calculate mean and standard deviation.	6/7	L3	CO5
17	In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for ? (i) 10 minutes or more (ii) Less than 10 minutes Between 10 and 12 minutes	6/7	L3	CO5
18	At a certain city bus stop, three buses arrive per hour on an average. Assuming that the time between successive arrivals is exponentially distributed, find the probability that the time between the arrival of successive buses is (i) less than 10 minutes (ii) at least 30 minutes.	6/7	L3	CO5
19	The length of telephone conversation in a booth has been an exponential distribution and found on an average to be 3 minutes. Find the probability that a random call made from this booth (i) Ends less than 3 minutes (ii) between 3 and 5 minutes.	6/7	L3	CO5
20	If x is an exponential variate with mean 4, Evaluate the following : $(i)\ P(0 < x < 1) \quad (ii)\ P(x > 2)\ and \quad (iii)\ P(-\infty < x < 10)$	6/7	L3	CO5
21	If X is a normal variate with mean30 and SD 5, find the probabilities that: $(i)\ 26 \le x \le 40 \quad (ii)\ x \ge 45\ and\ \ (iii)\ \lvert x - 30 \rvert > 5$ A(0.8)=0.2881, A(1.0)=0.3413, A(2.0)=0.4772, A(3.0)=0.4987	6/7	L3	CO5
22	In a consignment of 2000 lamps, it was found that the life of certain type of electric lamps was normally distributed with an average life of 2040 hours and SD of 60 hours. Evaluate the number of lamps to burn for: (i) More than 2150 hours (ii) Less than1950 hours (iii) More than 1920 hours and less than 2160 hours	6/7	L3	CO5

	A(1.8333)=0.0334, A(1.5)=0.0668, A(2)=0.4772			
23	In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation. A(0.5)=0.19, A(1.5)=0.42	6/7	L3	CO5
24	A certain number of articles manufactured in one batch were classified in to 3 categories according to a particular characteristic, being less than 50, between 50 and 60 and greater than 60. If this characteristic is known to be normally distributed, determine the mean and standard deviation of this batch if 60%, 35% and 5% were found in these categories. A(0.26)=0.1, A(1.65)=0.45	6/7	L3	CO5
25	In a test on electric bulbs, it was found that life time of a particular brand was distributed normally with an average life of 2000 hours and standard deviation of 60 hours. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for. (i) More than 2100 hours (ii) Between 1900 to 2100 hours (iii) Less than 1950 hours A(1.67)=0.4525, A(0.83)=0.2967,A(1.67)=0.4525	6/7	L3	CO5

Course Coordinator **Module Coordinator** **Program Coordinator/ HOD**